PHILADELPHIA UNIVERSITY FACULTY OF ENGINEERING

Department of Electrical Engineering

Course Title: Electrical Installation. **Prerequisite: Electrical Machines. (650321)**

Text Book: The design for electrical services of building, By : F porges,3rd Edition ,Taylor and France publishers ,2003,UK. ISBN 0-203-47308-6 Master e-book ISBN .

Semester: Second 2013/2014 **Instructor: Dr. Mohammed Tawfeeq**

Course Goals:

To introduce basic strictures of electrical installation distribution, equipments and materials.

Time Schedule:

Duration: 16 weeks **Lectures:** 3 hours / week

Objectives:

At completing this module the student should be able to:

1- Know of regulation of electrical installation systems.
2- Design and calculation of low voltage installations for buildings.
3- Have an idea about the protection and grounding .

Course Contents		
		Week
❖	**Introduction to electrical installation:** Wiring Regulations, Competence and responsibility, Procedure, Material, Design drawings, Voltage and voltage drop.	2
❖	**Electrical installation accessories :** Switches, Socket outlets ,Fused connection units, Boxes ,Lampholders , Ceiling roses etc.	1
❖	**Cables and wires :** Conductors, Insulation ,Sheathing , Type of cables , Cable laying methods , Wires , Volt-drops in cables and wires., PVC sheathed cable , XLPE cables, MICC External wiring Cable.	3
❖	**Wiring**: Conduit Plastic conduit, Cable trunking , Plastic trunking ,Metal conduit.	1
❖	**Illumination:** Lamps , Standards, Type of lighting and luminaires , Illumination technology, Methods of illumination calculation.	4
❖	**Load estimations :** Power calculations, Load factor ,Diversity factor, Circuits , Distribution boards.	2
❖	**Protection** : Rewirable fuses, H.R.C. fuses, M.C.B., MCCB ,RCD, R.C.C.B, Earthing systems.	2
❖	**Electronic and communication systems:** Fire alarm systems , Telephony systems , CCTV etc.	1

Mode of Assessment		
1	**First Exam**	**20%**
2	**Second Exam**	**20%**
3	**Reports\Homeworks\ and or Projects**	**20%**
4	**Final Exam**	**40%**

References

1.Electrical installation calculations Volume 1 A. J. Watkins and Chris Kitcher,Seventh edition . Elsevier publishers UK ,2006 ISBN–13 978-0-7506-6782.

2. Electrical installation calculations Volume 2 A. J. Watkins and Chris Kitcher,Seventh edition . Elsevier publishers UK ,2006 ISBN–13 978-0-7506-6782.

Electrical Installation

1. Introduction

Electrical installation describes the general aspects of electrical wiring as used to provide power in buildings and structures .

Electrical codes and standards

Wiring safety codes are intended to protect people and property from electrical shock and fire hazards. Regulations may be established by state or national legislation, produced by a technical standards-setting organization, or by a national standard electrical code. The cod gives design rules for electrical installations. The following cods are now applicable in many countries:

- In European countries, an attempt has been made to harmonize national wiring standards in an IEC standard, IEC 60364 Electrical Installations for Buildings. Hence national standards follow an identical system of sections and chapters.
- In the United Kingdom, wiring installations are regulated by the Institution of Engineering and Technology Requirements for Electrical Installations: IEE Wiring Regulations, BS 7671: 2008, which are harmonised with IEC 60364. The 17th edition (issued in January 2008) includes new sections for microgeneration and solar photovoltaic systems. The first edition was published in 1882.
- In Germany, DKE (the German Commission for Electrical, Electronic and Information Technologies of DIN and VDE) is the organisation responsible for the promulgation of electrical standards and safety specifications. DIN VDE 0100 is the German wiring regulations document harmonised with IEC 60364.
- In USA the US National Fire Protection Association, a private non-profit association formed by insurance companies, has published the National Electrical Code (NEC). States, counties or cities often include the NEC in their local building codes by reference along with local differences. The NEC is modified every three years. The proposals are studied by committees of engineers, tradesmen, manufacturer representatives, fire fighters, and others.

- In Jordan, the national Jordanian construction code centre has issued in 2008, the electrical installation code ,which is the same as the British IEE Wiring Regulations, BS 7671 .

كودات البناء الوطني الأردني – كودة التركيبات الكهربائية

- Arab code of electrical installation – Damascus, 2005.

الكود العربي للتمديدات الكهربائية – دمشق 2005 .

The international electric code: IEC 60364

IEC 60364 *Electrical Installations for Buildings* is the International Electrotechnical Commission's international standard on *electrical installations of buildings*. This standard is an attempt to harmonize national wiring standards in an IEC standard. The latest versions of many European wiring regulations (e.g., BS 7671 in the UK) follow the section structure of IEC 60364 very closely, but contain additional language to cater for historic national practice and to simplify field use and determination of compliance by electrical tradesmen and inspectors. National codes and site guides are meant to attain the common objectives of IEC 60364, and provide rules in a form that allows for guidance of persons installing and inspecting electrical systems.

The standard has several parts:

- Part 1: Fundamental principles, assessment of general characteristics, definitions
- Part 4: Protection for safety
  - Section 41: Protection against electric shock
  - Section 42: Protection against thermal effects
  - Section 43: Protection against overcurrent
  - Section 44: Protection against voltage disturbances and electromagnetic disturbances
- Part 5: Selection and erection of electrical equipment
  - Section 51: Common rules
  - Section 52: Wiring systems
  - Section 53: Isolation, switching and control
  - Section 54: Earthing arrangements, protective conductors and protective bonding conductors
  - Section 55: Other equipment
  - Section 56: Safety services

- Part 6: Verification
- Part 7: Requirements for special installations or locations
    - Section 701: Electrical installations in bathrooms
    - Section 702: Swimming pools and other basins
    - Section 703: Rooms and cabins containing sauna heaters
    - Section 704: Construction and demolition site installations
    - Section 705: Electrical installations of agricultural and horticultural premises
    - Section 706: Restrictive conductive locations
    - Section 708: Electrical installations in caravan parks and caravans
    - Section 709: Marinas and pleasure craft
    - Section 710: Medical locations
    - Section 712: Solar photovoltaic (PV) power supply systems
    - Section 713: Furniture
    - Section 714: External lighting
    - Section 715: Extra-low-voltage lighting installations
    - Section 717: Mobile or transportable units
    - Section 740: Temporary electrical installations for structures, amusement devices and booths at fairgrounds, amusement parks and circuses

Terminology

The Wiring Regulations carry a list of definitions for words and expressions which may not accord with standard dictionary definitions. Wherever there is any doubt, the Wiring Regulations definition should be applied.

Competence and responsibility

Any person involved with the installation of wiring in buildings takes on both legal and moral responsibilities for safety. A high level of technical and practical competence is essential. This can only be achieved with the appropriate study.

There are always three components to an electrical installation project:

- Design,
- Installation,
- Inspection and test.

Procedures

Design

It is sometimes thought that the use of tried and tested methods removes the design aspect from a scheme. This is not the case. Every project involves electrotechnical design decisions which are not to be confused with architectural or customer instructions for the physical location of electrical equipment. Thus, a self-employed electrical contractor who makes a decision on the selection and connection of an electrical accessory is a designer. The same applies to an electrician who makes a similar decision on behalf of an employer.

All technical design information must be recorded. This is a Wiring
514–09 Regulations requirement. IEE guidance is that it is essential to prepare a full specification prior to commencement or alteration of an electrical installation. The size and content of the specification will correspond with the complexity of the work. For simple jobs a few lines may suffice.

The designs shown in the following chapters are for guidance and each one includes a suggestion for a suitable design specification. A person selecting this guidance makes a design decision and therefore becomes the responsible person.

742–02 Upon completion of the contract the designer certifies that the design work is in accordance with the Wiring Regulations.

Installation

Where a technical design is drawn up by an electrical engineer or other competent person, it should not be the installer's job to check design details, unless this is one of the contract requirements. The installer is always under an obligation to point out to the designer any obvious conflict with regulations or standards and an installer should always refuse to carry out substandard work.

The installer has the responsibility to ensure that equipment is installed correctly and in accordance with the specification, supplemented by manufacturers' information. The installer is often delegated other tasks such as that of negotiating with the electricity supply company and verifying local licensing requirements.

Upon completion of the project, the installer certifies that the installation work has been carried out in accordance with the Wiring Regulations.

Inspection and test

No matter how simple or straightforward the job, test procedures must be carried out both during the course of the work and upon completion. This
711–01 applies equally to work carried out by a single self-employed operator. Self-certification is normally acceptable provided that the contractor has the competence and equipment to test correctly. The customer or an insurer may require specialist certification. This applies more particularly in the case of safety alarm systems or work in hazardous areas.

Whether an in-house or independent specialist, the inspector must be given the full design documentation with amendments showing any relevant on-site modifications. On larger projects this will include 'as fitted' drawings.

Certain parts of the installation may be hidden from view upon completion. In such cases the inspector must arrange for inspection during the course of erection or receive certified confirmation that the work is satisfactory.

Upon completion of the project, the inspector certifies that the inspection
741–01 and test have been carried out in accordance with the Wiring Regulations.

Completion

The signatures of the designer, installer and inspector are required for the
742–02 Electrical Installation Certificate. This cannot be issued until the work has been completed in accordance with the Wiring Regulations. Where there are acceptable departures from the Regulations, these must be shown on the certificate.

Materials

The Regulations require that every item of equipment shall comply with a
511–01 British Standard or harmonized European Standard. Alternatively, equipment complying with a relevant foreign standard may be used provided that the designer confirms that the equipment provides a degree of safety acceptable to the Regulations. This may mean product certification by an approvals organization.